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## TRANSMITTAL OF APPEAL BRIEF (Large Entity)

Docket No.  
UK998125US3

Inventor/Attorney: Garrity et al.

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
09/804,534	3/12/2001	Williams, Alexander O.	30449	2826	

Invention: PAD DESIGN ADAPTED FOR X-RAY INSPECTION

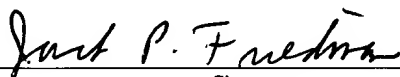
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DOCKET NO. UK998125US3

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Garrity *et al.*

Examiner: Williams, Alexander O.

Serial No.: 09/804,534

Art Unit: 2826

Filed: 3/12/01

For: **PAD DESIGN ADAPTED FOR X-RAY INSPECTION**

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**BRIEF OF APPELLANT**

This Appeal Brief, pursuant to the Notice of Appeal filed August 9, 2004, is an appeal from the rejection of the Examiner dated May 11, 2004.

**REAL PARTY IN INTEREST**

International Business Machines, Inc. is the real party in interest.

**RELATED APPEALS AND INTERFERENCES**

None.

**STATUS OF CLAIMS**

Claims 13-19 are currently pending.

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## **STATUS OF AMENDMENTS**

There are no After-Final Amendments which have not been entered.

## **SUMMARY OF INVENTION**

The present invention discloses an electrical structure, comprising a substrate and a substrate contact. The substrate is for the attachment of a ball grid array electronic package thereto by means of solder balls and solder paste wherein connection is made between a contact on the ball grid array electronic package and a solder ball by means of a first joining medium and between said solder ball. The substrate contact is arranged on the substrate. See specification, page 4, line 16 page 5, line 9.

The contact arranged on the substrate is substantially quadrilateral in shape (e.g., square in shape) and has at least one transverse dimension greater than a diameter of said solder ball. See specification, page 7, lines 3-7 and FIG. 6.

The substrate contact is configured on the substrate in relation to the solder ball such that an x-ray through said electronic package illuminates said solder ball and said contact, so that a bad joint shows in an x-ray image resulting from said x-rays as a round image of said solder ball and a good joint, in which said solder ball flows into said substantially quadrilateral shape (e.g., square shape), shows in said x-ray image as a quadrilateral image (e.g., square image). See specification, page 7, lines 8-18.

The joining medium may be solder paste. See specification, page 5, lines 19-21.

The solder ball may have an initial, substantially round shape prior to making said connections. See specification, page 5, lines 12-14.

The contact may have a thickness less than a thickness of said solder ball and a surface adapted for flowing said solder throughout said transverse dimension (see specification, page 5, lines 12-14 and FIG. 2.), so that in a good joint material from said solder ball flows to cover the transverse extent of said contact and produces an image different from a corresponding image of a bad joint. See specification, page 7, lines 8-18.

The surface may be adapted for flowing said solder throughout said transverse dimension is substantially planar, so that solder flow is unimpeded. See specification, page 5, lines 6-7.

Said at least one transverse dimension may be a diagonal of said quadrilateral that is greater in length than a corresponding diameter of said solder ball. See specification, page 7, lines 3-7 and FIG. 6.

## **ISSUES**

1. Whether claims 13-19 are unpatentable under 35 U.S.C. §103(a) over Hall et al (U.S. Patent 5,184,768) in view of Sakemi et al. (U.S. Patent 5,489,750).

## **GROUPING OF CLAIMS**

Claims 13-19 stand or fall together.

## ARGUMENT

### Issue 1

#### CLAIMS 13-19 ARE NOT UNPATENTABLE UNDER 35 U.S.C. §103(a) OVER HALL ET AL (U.S. PATENT 5,184,768) IN VIEW OF SAKEMI ET AL. (U.S. PATENT 5,489,750).

The Examiner rejected claims 13-19 as allegedly being unpatentable under 35 U.S.C. §103(a) over Hall et al (U.S. Patent 5,184,768) in view of Sakemi et al. (U.S. Patent 5,489,750).

Appellants respectfully contend that claim 13 is not unpatentable over Hall in view of Sakemi, because Hall in view of Sakemi does not teach or suggest each and every feature of claim 13.

Appellants respectfully contend that Hall in view of Sakemi does not teach or suggest the following first feature of claim 13: “a substrate for the attachment of a ball grid array electronic package thereto by means of solder balls and solder paste” (emphasis added). Note that claim 13 requires both solder balls and solder paste conjunctively (i.e., both solder balls and solder paste must be present).

The Examiner argues that reference numeral 28 in FIGS. 2A and 2B of Hall represent solder balls and solder paste together. Appellants respectfully disagree, because Hall identifies reference numeral 28 specifically as representing a solder ball (see Hall, col. 4, lines 11-13), and Hall nowhere teaches or suggests that reference 28 can represent a solder ball and solder paste together or even solder paste alone. In fact, Hall discloses an embodiment in FIGS. 4A and 4B in which solder paste 48 is present but no solder ball is present. Indeed, Hall classifies the embodiment of FIGS. 4A and 4B as “an **alternative embodiment** of the invention employing

**solder paste** on the substrate” (emphasis added) (see Hall, col. 4, lines 46-49. For further clarification, see Hall, col. 3, lines 56-59 in which Hall makes it clear that solder balls and solder paste are alternatives; i.e., “Solder material can be solder paste (as in the case of solder material applied to the substrate) or solder spheres (as in the case of solder material applied to the components)” (emphasis added). Applicants further note that the Examiner has not cited anything in Hall that allegedly discloses that the reference numeral 28 includes both a solder ball and solder paste together.

In summary, Appellants respectfully contend that Hall does not teach or suggest said first feature of claim 13 as alleged by the Examiner. Accordingly, Appellants respectfully contend that the Examiner has not established a *prima facie* case of obviousness in relation to claim 13.

Appellants respectfully contend that Hall in view of Sakemi does not teach or suggest the following second feature of claim 13: “wherein **the contact arranged on the substrate is substantially quadrilateral in shape** ..., wherein said substrate contact is configured on the substrate in relation to the solder ball such that an x-ray through said electronic package illuminates said solder ball and said contact, so that a bad joint shows in an x-ray image resulting from said x-rays as a round image of said solder ball and a good joint, in which said solder ball flows into said substantially quadrilateral shape, shows in said x-ray image as a quadrilateral image” (emphasis added).

The Examiner admits: “Hall et al. fail to explicitly show a substrate contact arranged on the substrate by means of a second joining medium and wherein the contact arranged on the substrate is **substantially quadrilateral in shape** and has at least one transverse dimension

greater than a diameter of said solder ball; in which said substrate contact is adapted for X-ray inspection by directing X-Rays through said electronic package to illuminate said solder ball and said contact, so that a bad joint shows in said x-rays as a round image of said solder ball and a good joint, in which said solder ball flows into said substantially quadrilateral shape, shows in said X-rays as a quadrilateral image.”

The Examiner argues: “Sakemi et al. is cited for showing an electronic part with bumps on a circuit board. Specifically, Sakemi et al. (figures 7a to 16) specifically figures 7a and 7c discloses and a substrate contact 6 arranged on the substrate 20 by means of a second joining medium 4 and wherein the contact arranged on the substrate is substantially quadrilateral in shape and has at least one transverse dimension greater than a diameter of said solder ball; in which said substrate contact is adapted for X-ray inspection by directing X-Rays through said electronic package to illuminate said solder ball and said contact, so that a bad joint shows in said x-rays as a round image of said solder ball and a good joint, in which said solder ball flows into said substantially quadrilateral shape, shows in said X-rays as a quadrilateral image **for the purpose of accurately determining the bonding quality in the appearance inspection between a substrate and device**” (emphasis added).

In response to the preceding argument by the Examiner, Appellants respectfully offer the following two arguments as to why it is not obvious to modify Hall by the alleged teaching of Sakemi with respect to said second feature of claim 13.

Appellants’ first argument as to why it is not obvious to modify Hall by the alleged teaching of Sakemi with respect to said second feature of claim 13 is that modifying Hall to make

to have the substrate contact 22, 24 (as identified by the Examiner) substantially quadrilateral in shape would destroy Hall's invention. The Examiner relies on the embodiment of FIGS. 2A and 2B of Hall. However, the embodiment of FIGS. 2A and 2B of Hall **requires** the existence of the extended tab portion 24 of the substrate contact. See Hall, col. 4, lines 2-4 ("Each solder pad 22 contains a tab or tabular portion 24 **extending beyond the perimeter of the solder pad 22**" (emphasis added)). See also the tab portion 24 in FIGS. 2A and 2B.

Moreover, the existence of the extended tab portion 24 of the substrate contact is an important aspect of Hall's invention, because the presence or absence of the extended tab portion 24 on an X-ray image indicates whether good solder joint or a defective solder joint exists as explained in Hall, col. 4, lines 27-45. See especially Hall, col. 4, lines 43-45 ("The proper solder joint 38 possesses a shape or profile containing the portion **extending beyond the circular solder joint perimeter**. An improper solder joint 39 shows only a circular profile and **does not contain the portion extending beyond the perimeter**"). Therefore, the extended tab portion 24 of the substrate contact is an important aspect Hall's invention.

However, the existence of the extended pad portion 24 of the substrate contact, which extends beyond the perimeter of the solder pad, makes it **physically impossible** for the substrate contact 22, 24 in Hall to have a quadrilateral shape. Accordingly, modification of Hall's invention to provide the substrate contact with a quadrilateral shape would force the extended tab portion 24 to be removed from the substrate contact and Hall's invention would be destroyed. Therefore, Appellants maintain that it is not obvious to modify Hall to provide the substrate contact with a quadrilateral shape. Accordingly, Appellants respectfully contend that the Examiner has not established a *prima facie* case of obviousness in relation to claim 13.



Appellants' second argument as to why it is not obvious to modify Hall by the alleged teaching of Sakemi with respect to said second feature of claim 13 is that Hall's invention, as disclosed by Hall, already accurately determines the bonding quality in the appearance inspection between a substrate and device, so that the alleged advantage of Sakemi's alleged quadrilateral shape already exists in Hall and therefore offers nothing to Hall. Indeed, Hall discloses:

"Note that the cross-sectional profile of a properly wetted solder joint 38 is significantly different from the cross-sectional profile of an improperly formed solder joint 39. The proper solder joint 38 is wet to the substrate solder pad 32, and also to the substrate solder pad extension 34. By inspecting the solder joints using x-ray equipment, the configuration of a properly wet solder joint 38 in FIG. 3B can be seen to be significantly different than the improperly formed solder joint 39. The proper solder joint 38 possesses a shape or profile containing the portion extending beyond the circular solder joint perimeter. An improper solder joint 39 shows only a circular profile and does not contain the portion extending beyond the perimeter".

See Hall, col. 4, lines 32-45. In fact, the preceding quote from Hall is the essence of Hall's invention (see Hall, col. 2, line 58 - col. 3, line 2; Abstract).

Therefore, since Hall's invention already accurately determines the bonding quality in the appearance inspection between a substrate and device, and since Hall's disclosure of a novel method of determining the bonding quality in the appearance inspection between a substrate and device is the essence of Hall's invention, Appellants respectfully contend that the Examiner's argument for modifying Hall with the alleged teaching of Sakemi is not persuasive. In effect, the Examiner argues for incorporating an alleged advantage of Sakemi that Hall's invention already enjoys without utilizing Sakemi.

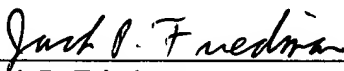
Accordingly, Appellants respectfully contend that the Examiner has not established a *prima facie* case of obviousness in relation to claim 13.

Based on the preceding arguments, Appellants respectfully maintain that claim 13 is not unpatentable over Hall in view of Sakemi, and that claim 13 is in condition for allowance. Since claims 14-19 depend from claim 13, Appellants contend that claims 14-19 are likewise in condition for allowance.

### SUMMARY

In summary, Appellant respectfully requests reversal of the May 11, 2004 Office Action rejection of claims 13-19.

Respectfully submitted,

  
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**APPENDIX - CLAIMS ON APPEAL**

13. An electrical structure, comprising:

a substrate for the attachment of a ball grid array electronic package thereto by means of solder balls and solder paste wherein connection is made between a contact on the ball grid array electronic package and a solder ball by means of a first joining medium and between said solder ball; and

a substrate contact arranged on the substrate wherein the contact arranged on the substrate is substantially quadrilateral in shape and has at least one transverse dimension greater than a diameter of said solder ball,

wherein said substrate contact is configured on the substrate in relation to the solder ball such that an x-ray through said electronic package illuminates said solder ball and said contact, so that a bad joint shows in an x-ray image resulting from said x-rays as a round image of said solder

ball and a good joint, in which said solder ball flows into said substantially quadrilateral shape, shows in said x-ray image as a quadrilateral image.

14. The electrical structure of claim 13, wherein the contact arranged on the substrate is substantially square in shape; so that a good joint shows in said x-rays as a square shape.

15. The electrical structure of claim 13 wherein the joining medium is solder paste.

16. The electrical structure of claim 13 wherein said solder ball has an initial, substantially round shape prior to making said connections.

17. The electrical structure of claim 13, wherein said contact has a thickness less than a thickness of said solder ball and a surface adapted for flowing said solder throughout said transverse dimension, so that in a good joint material from said solder ball flows to cover the transverse extent of said contact and produces an image different from a corresponding image of a bad joint.

18. The electrical structure of claim 17, wherein said surface adapted for flowing said solder throughout said transverse dimension is substantially planar, so that solder flow is unimpeded.

19. The electrical structure of claim 14, wherein said at least one transverse dimension is a diagonal of said quadrilateral that is greater in length than a corresponding diameter of said solder ball.